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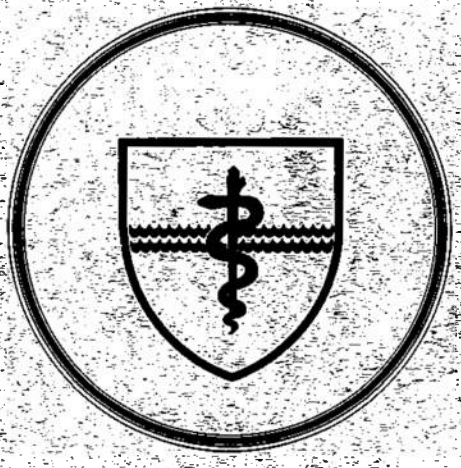

REPORT NUMBER 1016

AN EVALUATION OF THE ABILITY OF NAVY HOSPITAL CORPSMEN TO COLLECT CHEST PAIN DATA FROM PATIENTS

by

Karen D. FISHERKELLER, George MOELLER, Bernard L. RYACK, and Jean GOUDY

Naval Medical Research and Development Command
Research Work Unit MF58.527.1C1-0001

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W. C. MILROY, CAPT, MC, USN
Commanding Officer
Naval Submarine Medical Research Laboratory

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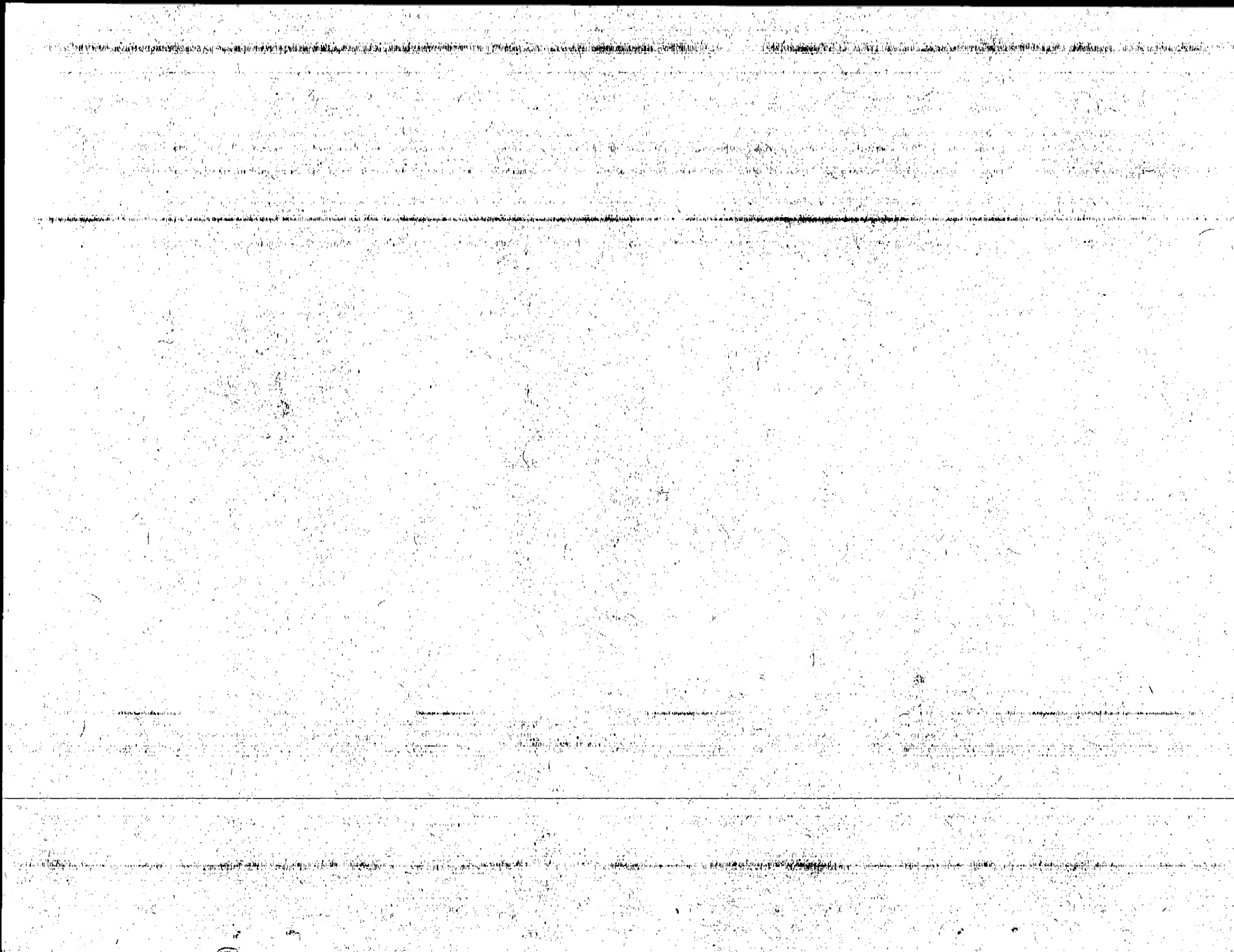

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SUMMARY PAGE

THE PROBLEM

To evaluate the ability of Navy Hospital Corpsmen to collect chest pain data from patients presenting at an emergency room.

FINDINGS

The overall agreement between the chest pain findings of medical officers and Navy Hospital Corpsmen was 64% for 24 observed cases and 72% for 78 non-observed cases. The use of agreement between the findings of corpsmen and physicians as a method of evaluating the corpsmen's ability to collect data from patients with chest pain was not optimal since it was mostly a measure of their agreement with the medical officers on normal findings. Observers' ratings show that data collection skills are better for history than for physical exam items. The type of errors made in collecting data on history categories is such that additional training could improve performance. Errors made in the collection of data on physical exam categories are more significant. In addition to training in the proper techniques to use in collecting physical exam data, the corpsmen need instruction in how to interpret the elicited data. Resolution of this problem may require more clinical, "hands-on" training with on-site feedback from senior personnel.

APPLICATIONS

This study provides information on the Navy Hospital Corpsmen's ability to collect data from patients with acute chest pain. Such information is relevant to the development of a computer-based medical diagnostic program for chest pain to be used by corpsmen in isolated environments.

ADMINISTRATIVE INFORMATION

This investigation was conducted as part of the Bureau of Medicine and Surgery Research Work Unit MF58.527.1C1-0001 - "A computer based medical diagnosis/patient management system for use aboard submarines." It was submitted for review on 14 December 1983, approved for publication on 11 January 1984 , and has been designated as Naval Submarine Medical Research Laboratory Report No. 1016 .

Published by the Naval Submarine Medical Research Laboratory

ABSTRACT

Sixteen Navy Hospital Corpsmen received instruction in the definition of chest pain signs and symptoms, and in specific data collection procedures. The corpsmen conducted examinations of 102 patients presenting at an emergency room with chest pain. Their ability to collect history and physical exam data was evaluated by observation, and by the agreement between the findings of the corpsmen and those of the physician. The use of agreement with the physician as a method of evaluating the corpsmen's ability to collect data was found unsatisfactory. Agreement between physicians and corpsmen could have resulted from very accurate judgments by the latter or it could have been a by-product of reports by both groups that normal findings predominated. The observers' ratings showed the corpsmen's investigation of many history categories to be accurate and complete. The kind of errors made suggest that additional training could easily improve performance. The corpsmen's performance was not as good on physical exam categories. The kind of errors made suggest that the corpsmen need further instruction in procedures to collect data, and in interpretation of elicited data. Resolution of this problem may require more clinical, "hands-on" training with on-site feedback from senior personnel.

AN EVALUATION OF THE ABILITY OF NAVY HOSPITAL CORPSMEN TO COLLECT CHEST PAIN DATA FROM PATIENTS

INTRODUCTION

As the Navy's medical representative aboard the submarine, it is the responsibility of the independent duty corpsman to appropriately diagnose and manage medical problems as they occur at sea. The significance of the corpsmen's recommendation for both the mission and the well-being of the crew has led to the development of diagnostic aids for the corpsmen's use in isolated environments (Henderson, et al., 1978; Ryack, et al, 1979). Computer-based medical diagnostic programs have been initiated in the areas of abdominal and chest pain since illnesses of this type have been reported to be the most frequent cause of medical evacuation (Ryack, et al, 1976; SUBLANT MEDEVAC Statistics, 1977-1979). Before the computer-based programs can be implemented, the corpsmen need to know how to collect the data required for use by the diagnostic system. The study reported here is an investigation of the ability of Navy corpsmen to collect history and physical exam data employed by a computer-based program for the diagnosis of chest pain.

METHOD

Subjects

Sixteen Hospital Corpsmen (corpsmen) and 22 Navy physicians (Medical Officers) participated in the study. Both the corpsmen and physicians were stationed at the Naval Hospital, Groton, CT (NHGRTN). The corpsmen were assigned to duty in the hospital emergency room. Of the 16 corpsmen, there were two hospitalmen apprentices (HA), 10 hospitalmen (HN), three hospital corpsmen 3rd class (HM3), and one hospital corpsman 2nd class (HM2).

Materials

A chest pain datasheet was used by the corpsmen and physicians to record history and physical findings (see Figure 1). The datasheet consists of 21 history and 17 physical examination categories. These categories were recommended (de Dombal, 1979) as most useful to the diagnosis of chest pain illness when EKG data are not available. They were derived from a retrospective population of young, healthy men with chest pain and no prior history of same (de Dombal, 1979). An observation form completed by trained observers present at the examination was used to rate the corpsmen's ability to collect information on the datasheet. The symptom categories and specific criteria used to rate the corpsmen's performance are shown in Figure 2. The criteria were based on the definitions set forth in the datasheet for each of the symptom categories. For example, numbness was defined as either the absence of sensation or tingling, as it occurs during the present illness. The criteria used to rate the

Figure 1: Chest pain datasheet used by corpsmen and physicians to record patient findings.

CHEST PAIN DATA SHEET

PATIENT NAME: _____ **AGE:** _____

SSN: _____ **DATE/TIME:** _____

HISTORY

PAIN

DURATION OF PAIN:
(duration of this episode of pain)
<1HR (5) 2-4HR (7)
1-2HR (6) 4-12HR (8)
>12HR (9)

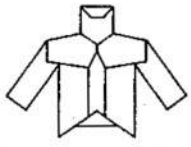
ONSET OF PAIN:
(sudden < 2 Min; gradual > 2 Min)
SUDDEN (10) GRADUAL (11)

TIME COURSE OF PAIN:
(at times free of pain = intermittent; everything else = continuous)
CONTINUOUS (12)
INTERMITTENT (13)

RADIATION:
(pain other than in chest area)
YES (14) NO (15)

SITE OF PAIN:
(have the patient point with one finger to where the pain is)

RADIATES TO:
(location of radiated pain; ask about each)



SUBSTERNAL	(16)	RT. SIDE	(19)	LT. ARM	(22)	SHOULDER	(26)
ACROSS	(17)	EPIGASTRIC	(20)	RT. ARM	(23)	NECK	(27)
LT. SIDE	(18)	OTHER	(21)	BOTH ARMS	(24)	JAW	(28)
				BACK	(25)	OTHER	(29)

NUMBNESS:
(this illness only; absence of sensation or a tingling feeling)
YES (30) NO (31)

SEVERITY OF PAIN:
(do not ask; obvious distress = severe; everything else = moderate)
MODERATE (32) SEVERE (33)

PROGRESS OF PAIN:
(general trend of pain rather than short-term changes)
BETTER (34) WORSE (35)

AGGRAVATING FACTORS:
(factors which make the pain worse; ask & perform each unless ? MI)
MOVEMENT (36) COUGH (37) BREATHING (38)
SITTING (39) OTHER (40) NONE (41)

RELIEVING FACTORS:
(activities which ease the pain; ask about each)
NITRO (42) REST (43) WALKING (44)
OTHER (45) NONE (46)

OTHER SYMPTOMS

DYSPNEA:
(shortness of breath; recent = this illness, chronic = habitual)
NO (47) THIS ILLNESS (48) HABITUAL (49)

COUGH:
(recent cough = this illness; chronic cough = habitual)
NO (50) THIS ILLNESS (51) HABITUAL (52)

NAUSEA:
(feeling sick to stomach)
YES (53) NO (54)

VOMITING:
(being sick to stomach)
YES (55) NO (56)

APPETITE:
(recent change in appetite)
NORMAL (57) DECREASED (58)

BOWELS:
(recent change in bowel habits)
NORMAL (59) CONSTIPATED (60) DIARRHEA (61)

PAST HISTORY

PREVIOUS CHEST PAIN:
(pain like this before)
YES (62) NO (63)

PREVIOUS CARDIO-RESPIRATORY ILLNESS:
(significant illness either cardiovascular or respiratory)
YES (64) NO (65)

PREVIOUS MAJOR SURGERY:
(major surgery of any kind)
YES (66) NO (67)

PHYSICAL EXAM

VITAL SIGNS

TEMPERATURE		PULSE		BLOOD PRESSURE systolic		BLOOD PRESSURE diastolic	
<98.6	(68)	<60	(72)	<100	(76)	<70	(81)
98.6-100.2	(69)	60-80	(73)	100-120	(77)	70-80	(82)
100.3-102	(70)	81-100	(74)	121-140	(78)	81-90	(83)
>102	(71)	>100	(75)	141-160	(79)	91-100	(84)
				>160	(80)	>100	(85)

MOOD:
(don't ask; obvious distress or physical symptoms = distressed; just worried about illness = anxious)
NORMAL (86) ANXIOUS (87) DISTRESSED (88)

COLOR:
(consider environmental temp.; check conjunctiva & palms on black & oriental)
NORMAL (89) PALE (90) FLUSHED (91) CYANOTIC (92)

EXAMINATION

SWEATING:
(check for sweating not due to environment or exercise)
YES (93) NO (94)

SHIVERING:
(check for shivering not due to environment; e.g. cold compartment)
YES (95) NO (96)

JUGULAR VENOUS PULSE:
(pt. reclined at 45 degrees, chin 30 degrees to left; meniscus more than ⅓ of the distance from clavicle to chin = elevated; otherwise circle normal)
NORMAL (97) RAISED (98)

RESPIRATORY MOVEMENT:
(abnormal = the difference between full inspiration & full expiration is less than 2 inches or expansion is unequal between sides; otherwise circle normal)
NORMAL (99) ABNORMAL (100)

HEART SOUNDS:
(with a stethoscope listen to the 1st and 2nd heart sounds; normal = lub-dub, lub-dub; abnormal = everything else)
NORMAL (101) ABNORMAL (102) (PVC'S____ S_3/S_4____)

PERCUSSION:
(percuss both front & back; dull = less resonant than normal; hyper-resonant = markedly more resonant than normal; otherwise circle normal)
NORMAL (103) DULL (104) HYPER-RESONANT (105)

CHEST SOUNDS:
(Compare left to right sides; rhonchi = continuous musical sounds; rales = discrete, non-continuous sounds; decreased = one side markedly decreased)
NORMAL (106) RHONCHI (107) RALES (108) DECREASED (109)

SGOT:
(enzyme test)
<50 (110) 50-100 (111) 101-200 (112) >200 (113)

BODY BUILD:
(obviously overweight = obese; otherwise circle normal)
NORMAL (114) OBESE (115)

DURATION OF PAIN (REFINED):
(complete this item only for repeated examinations of the patient)
<6HR (116) 6-24HR (117) >24HR (118)

EXAMINER'S OPINION OF THE PATIENT'S CONDITION:
(how sick do you feel the patient is)
GOOD (119) FAIR (120) POOR (121)

CORPSMAN'S DIAGNOSIS:
(mark your diagnosis)
( ) MYOCARDIAL INFARCTION
( ) ANGINA
( ) NONSPECIFIC CHEST PAIN
( ) PNEUMONIA
( ) PNEUMOTHORAX
( ) OTHER (specify)

M.O.'S DIAGNOSIS:
(mark your diagnosis)
( ) MYOCARDIAL INFARCTION
( ) ANGINA
( ) NONSPECIFIC CHEST PAIN
( ) PNEUMONIA
( ) PNEUMOTHORAX
( ) OTHER (specify)

EXAMINING CORPSMAN: _____

EXAMINING M.O.: _____

OBSERVATION FORM
CHEST PAIN

PATIENT: TIME/DATE:
SSN: ER/CCU:

HISTORY

DURATION: _____
(distinguish present from past episodes; min/hrs.)

ONSET: _____
(distinguish sudden from gradual)

TIME COURSE: _____
(Is the patient ever free of pain?)

SITE OF PAIN: _____
(bare chest; point with 1 finger to area of pain)

RADIATION: _____
(Is pain located in other areas?)

RADIATES TO: _____
(points; asks re: areas, arms, back, neck, etc.)

NUMBNESS: _____
(Numbness or tingling; not pre-existing)

SEVERITY: _____
(based on observation; do not question patient)

PROGRESS: _____
(distinguish general trend from short-term changes)

AGGRAVATING FACTORS: _____
(neutral questions; have patient move, cough, breathe, sit; do not perform if MI)

RELIEVING FACTORS: _____
(neutral questions; ask re: nirto, rest, walk & other)

DYSPNEA: _____
(present/absent; chronic or acute)

COUGH: _____
(present/absent; chronic or acute)

NAUSEA: _____
(distinguish feeling sick from being sick)

VOMITING: _____
(distinguish vomiting from reflux; this illness)

APPETITE: _____
(recent change from normal eating habits)

BOWELS: _____
(recent change; definite not subtle changes)

PREVIOUS CHEST PAIN: _____
(similar chest pain in the past)

PREVIOUS ILLNESS: _____
(cardio-vas. or pulmonary; ask re: angina, BP, MI, asthma, etc.)

PREVIOUS MAJOR SURGERY: _____
(surgery done under general anesthesia; not trivial or tonsillectomy)

COMMENTS:

CODES:

0: NOT DONE
1: DONE, BUT INCORRECTLY OR INCOMPLETELY
2: DONE CORRECTLY AND COMPLETELY
X: NOT APPLICABLE

OBSERVER:

Figure 2: History section of the observation form used by observers.

corpsmen's performance on numbness were two-fold: determine if numbness or tingling is present or absent, and determine that it is not pre-existing.

The corpsmen's skill in collecting data on a particular category was rated on a 4-point scale: '0-2' and 'X'. A rating of '0' indicated that the corpsman made no attempt to collect data on a particular category; a rating of '1' indicated that the corpsman made an attempt to collect data, but his investigation of the symptom was incorrect or incomplete; a rating of '2' indicated that all the criteria for that symptom were met, and a rating of 'X' was used if the observer was unable to judge the corpsman's investigation of a particular symptom.

For most categories, the observers based their ratings on the type of questions or procedures used by the corpsmen to elicit data from the patient. However, for the history category of Severity and the physical exam categories of Mood, Color, Sweating, and Shivering, the corpsman's findings are based on his observations of the patient. As a result, it was sometimes difficult for the observers to rate the corpsmen's performance on these categories. To mark those occasions, the observers assigned a rating of 'X' when they were unable to judge the corpsman's performance. Later, the corpsman's findings for these categories were compared to those of the physician. If they were in agreement, the corpsman received a rating of '2'; and if they disagreed he received a rating of '1'. The number of times that agreement with the physician's findings rather than observer ratings was used to measure performance varied among symptom categories and is discussed in the results section.

Procedure

All corpsmen received 2 hours of didactic instruction in the use of the chest pain datasheet. This included instruction in the standardized definition of chest pain signs and symptoms and specific data collection procedures (de Dombal, 1979). During their normal duty in the emergency room, corpsmen examined patients who presented to the emergency room with chest pain, but who were not in extremis. The corpsman used the chest pain datasheet as a guide in conducting his examination and recorded all history and physical findings on the datasheet. The corpsman was instructed to not consult with the physician or any other medical personnel in performing his examination or in completing the chest pain form. A second examination of the patient was performed by a physician, who recorded his findings on a separate chest pain datasheet.

The corpsmen did not examine patients presenting at the emergency room who were in a life-threatining situation or who were so ill that the emergency room staff felt that the patient's treatment might be compromised.

Once the patient's condition had stabilized and the patient's physician gave his consent, the corpsman conducted an examination of the patient in the Intensive Care Unit, using the datasheet as a guide and recording his findings on the form. The patient's physician was asked to record his findings on a separate datasheet, as near as possible in time to the corpsman's examination.

The corpsman's examination of patients in the Intensive Care Unit and of patients presenting to the emergency room on weekdays between the hours of 8:00 a.m. and 4:30 p.m. was observed by one or two trained observers. For each of the items on the chest pain observation form, the observer rated whether the corpsman made an attempt to collect data on a particular item, and whether his investigation was correct and complete. On items where the corpsman's technique was other than the suggested one, the observers noted in what way the corpsman's performance differed from the suggested technique.

Observer Training

Before the start of the study, five people from the Naval Submarine Medical Research Laboratory (NSMRL), Groton, CT were trained as observers. There were two submarine qualified chief hospital corpsmen (HMC(SS)), one hospital corpsman 1st class (HM1), one hospital corpsman 3rd class (HM3), and a master's level research psychologist. The psychologist had prior experience observing the ability of Navy corpsmen to perform examinations on patients with abdominal pain.

Five videotaped chest pain examinations of laboratory personnel simulating actual cases were made to use in training the observers. Each 'patient' was instructed in the history and physical symptoms for one of the cases. A case each of myocardial infarction, angina, and pneumonia, and two cases of nonspecific chest pain were simulated. A physician from NHGRTN conducted examinations of the five patients. He varied his thoroughness and accuracy in performing the examinations to provide a range of behavior on which to train the observers. The observers then watched the five examinations and rated the examiner's performance on individual symptom categories, receiving feedback as to the accuracy of their ratings. As a test, they reviewed the videotaped examinations again and recorded their ratings, but this time without receiving any feedback. All inter-rater correlations equaled or exceeded $r = .77$.

RESULTS

Between November 1982 and July 1983, emergency room corpsmen performed history and physical examinations, and completed chest pain datasheets for 102 patients. Twenty-four of the 102 examinations performed by corpsmen were rated by at least one observer; 17 of the

observed cases were seen in the emergency room and the remaining 7 cases were seen in the intensive care unit. Due to the busy schedule of the emergency room, the physicians were able to complete datasheets for only 52 non-observed and 19 observed cases.

The data were analyzed in two ways. First, agreement between the findings of the corpsmen and the physicians was determined (accuracy). Second, the corpsmen's ability to collect data from patients, using the suggested techniques and procedures was evaluated by observation. As noted earlier, when the corpsman's performance could not be judged solely from observation, agreement between the corpsman's and physician's findings was used as a measure of his performance, e.g. for Severity, Mood, Color, Sweating, and Shivering.

Accuracy on Observed Cases

Table 1 presents the symptom findings recorded by the corpsmen and physicians for the observed cases, and the percentage agreement between their findings. The corpsmen completed datasheets for 24 cases that were observed, and the physicians completed datasheets for 19 of the 24 cases. Column 1 gives the number of times the corpsmen recorded a particular finding. For example, the corpsmen recorded a finding for Onset of Pain for 22 of the 24 observed cases. They recorded that the Onset of Pain was sudden for 14 of the cases and that it was gradual for 8 cases. The same type of information is presented in column 2 for the 19 cases seen by the physicians. Columns 3 and 4 give the frequency, in number and percentage, with which the corpsmen's and physicians' findings were in agreement. In the calculation of their agreement, the corpsman's failure to record a finding (missing data) was counted as an error. The frequency of missing data on cases for which physician data are available is given in column 5. For example, the physicians recorded numbness as present on 3 cases and absent on 16 cases. The corpsmen's findings were in agreement on 2 of the 3 cases where numbness was present (accuracy = 67%) and on 10 of the 16 cases where it was absent (63%). For the symptom category of numbness, the physician and corpsmen were in agreement on 12 of the 19 cases (63%). On 2 of the cases in disagreement, the corpsman's finding was missing rather than explicitly different from that recorded by the physician.

On a number of categories, it was possible for more than one finding to be present for a given patient. These categories were Site, Radiates To, Aggravating, and Relieving Factors. For example, a patient might report that both movement and cough aggravate his pain. For this reason, the number of findings recorded for these categories sometimes exceeds the total

Table 1: Symptom findings recorded by corpsmen and physicians, and the number and percent agreement between their findings on 24 observed cases of chest pain.

SYMPTOM CATEGORY	HN DATA	MO DATA	AGREEMENT #	AGREEMENT %	MISSING DATA
AGE	21	18	15	83	3
<30	1	1	1	100	
30-39	4	3	3	100	
40-49	4	4	4	100	
49+	12	10	7	70	
DURATION	23	19	7	37	1
<1hr	5	8	3	38	
1-2 hr	3	2	0	0	
2-4 hr	5	2	0	0	
4-12 hr	1	2	0	0	
>12 hr	9	5	4	80	
ONSET	22	18	12	67	1
sudden	14	14	9	64	
gradual	8	4	3	75	
TIME COURSE	23	19	12	63	1
continuous	6	9	4	44	
intermittent	17	10	8	80	
RADIATION	21	18	11	61	2
present	15	8	7	88	
absent	6	10	4	40	
SITE	25	21	13	62	1
central	12	10	8	80	
across	2	1	1	100	
lt. side	6	4	3	75	
rt. side	3	2	0	0	
epigastric	0	2	0	0	
other	2	2	1	50	
RADIATES TO	24	13	9	69	1
left arm	9	6	4	67	
right arm	2	1	1	100	
both arms	2	0	0	-	
back	4	3	2	67	
shoulder	3	0	0	-	
neck	3	2	1	50	
jaw	1	1	1	100	
other	0	0	0	-	
NUMBNESS	22	19	12	63	2
present	9	3	2	67	
absent	13	16	10	63	
SEVERITY	23	19	13	68	1
moderate	16	18	13	72	
severe	7	1	0	0	
PROGRESS	21	17	8	47	3
better	14	10	5	50	
worse	7	7	3	43	
AGGRAVATING	28	21	10	48	1
movement	10	6	4	67	
cough	3	2	1	50	
breathing	3	3	1	33	
sitting	2	0	0	-	
other	4	0	0	-	
none	6	10	4	40	
RELIEVING	27	21	3	14	1
nitro	6	5	2	40	
rest	14	4	1	25	
walking	1	0	0	-	
other	4	0	0	-	
none	2	12	0	0	
DYSPNEA	23	19	8	42	1
no	10	16	6	38	
this illness	8	3	2	67	
habitual	5	0	0	-	
COUGH	22	19	12	63	2
no	14	16	10	63	
this illness	5	2	2	100	
habitual	3	1	0	0	
NAUSEA	22	19	16	84	1
present	4	2	1	50	
absent	18	17	15	88	
VOMITING	23	19	18	95	1
present	0	1	0	0	
absent	23	18	18	100	
APPETITE	23	19	15	79	1
normal	19	18	15	83	
decreased	4	1	0	0	
BOWELS	23	18	16	89	1
normal	22	18	16	89	
constipated	0	0	0	-	
diarrhea	1	0	0	-	

SYMPTOM CATEGORY	HN DATA	MO DATA	AGREEMENT #	AGREEMENT %	MISSING DATA
PREVIOUS PAIN	23	19	12	63	1
present	13	9	7	78	
absent	10	10	5	50	
PREV. ILLNESS	23	19	16	84	1
present	10	6	5	83	
absent	13	13	11	85	
PREV. SURGERY	22	18	11	61	1
present	12	5	4	80	
absent	10	13	7	54	
TEMPERATURE	15	16	9	56	5
<98.6	7	10	6	60	
98.6-100.2	8	5	3	60	
100.3-102	0	1	0	0	
>102	0	0	0	-	
PULSE	21	18	10	56	3
<60	0	0	0	-	
60-80	13	7	5	71	
81-100	7	7	4	57	
>100	1	4	1	25	
BP-SYSTOLIC	20	18	9	50	4
<100	0	0	0	-	
100-120	4	2	2	100	
121-140	7	6	3	50	
141-160	6	8	3	38	
>160	3	2	1	50	
BP-DIASTOLIC	20	18	9	50	4
<70	0	1	0	0	
71-80	9	6	4	67	
81-90	6	4	2	50	
91-100	4	6	3	50	
>100	1	1	0	0	
MOOD	23	19	11	58	1
normal	16	14	10	71	
anxious	5	5	1	20	
distressed	2	0	0	-	
COLOR	23	19	12	63	1
normal	18	17	12	71	
pale	2	1	0	0	
flushed	3	0	0	-	
cyanotic	0	1	0	0	
SWEATING	23	19	17	89	1
present	1	0	0	-	
absent	22	19	17	89	
SHIVERING	23	18	17	94	1
present	1	0	0	-	
absent	22	18	17	94	
JVP	19	18	12	67	4
normal	17	19	12	67	
raised	2	0	0	-	
RESP. MOVE.	20	19	13	68	4
normal	18	19	13	68	
raised	2	0	0	-	
HEART SOUNDS	23	19	14	74	1
normal	22	15	14	93	
abnormal	1	4	0	0	
PERCUSSION	21	19	15	79	3
normal	20	19	15	79	
dull	1	0	0	-	
hyper-resonant	0	0	0	-	
CHEST SOUNDS	23	19	15	79	1
normal	21	17	15	88	
rhonchi	0	1	0	0	
rales	1	1	0	0	
decreased	1	0	0	-	
BODY BUILD	23	19	9	47	1
normal	12	10	6	60	
obese	11	9	3	33	
EXAMINERS OPINION	21	17	5	29	3
good	9	11	3	27	
fair	12	5	2	40	
poor	0	1	0	0	

number of patients.

Across all symptom categories and for the history and physical exam separately, the agreement between the findings of the corpsmen and physicians was 64%. The corpsmen were least accurate on the history categories of Duration, Progress, Aggravating factors, Relieving factors, and Dyspnea, and on the physical exam categories of Temperature, Pulse, Blood pressure, Mood, Body build, and Examiner's opinion. On each of these categories, their accuracy was less than 60%.

Performance Ratings on Observed Cases

For each of the 24 cases, the corpsmen's ability to collect history and physical exam data according to suggested techniques was rated by at least one observer. Sixteen of the cases were rated by two trained observers. One observer (research psychologist) was present for all cases. The other four observers rated the corpsmen's performance on 1, 2, 4, and 9 cases. The mean correlations between the ratings assigned by the primary observer (research psychologist) and each of the secondary observers were: .64 (1 observed case), .87 (2 cases), .82 (4 cases) and .83 (9 cases); each of the correlations was significant at $p < .01$. Disagreements between the ratings assigned by the observers showed no particular pattern.

A number of categories listed on the chest pain datasheet were not evaluated by the observation form. They were SGOT, Body build, Duration of pain (refined), and Examiner's opinion of the patient's condition. SGOT is not assessed routinely on patients with chest pain at NHGRTN. Findings for the remaining 3 categories are only relevant to the prediction of prognosis on patients for whom there is suspicion of myocardial infarction; they do not enter into the initial diagnosis. In addition, the symptom categories of Radiation and Radiates to and Systolic and Diastolic were combined on the observation form and evaluated as Radiation and Blood pressure.

Failure to Collect Data

The ratings assigned by the primary observer for each symptom category and across all observed cases are presented in Table 2. A rating of '0' was assigned if the corpsman did not make an attempt to collect any data for the particular symptom category. This rating was assigned most often to the categories of Age (number of 0's assigned was 20), Temperature (19 0's), Pulse (10 0's), Blood pressure (12 0's), and Respiratory movement (19 0's). All of these categories, except Respiratory movement, were ones that the corpsmen routinely collected data on prior to the examination, at the check-in desk of the emergency room. While in many instances the corpsmen were not observed to have

Table 2: Ratings assigned by the primary observer across 24 observed cases.

	SYMPTOM CATEGORY	RATINGS 0	1	2	X
History Categories	Age	20	0	4	0
	Duration	0	5	19	0
	Onset	3	12	9	0
	Time course	0	3	21	0
	Site	5	13	6	0
	Radiation	4	9	11	0
	Numbness	4	9	11	0
	Severity	0	15	7	2
	Progress	4	2	18	0
	Aggravating factors	0	13	11	0
	Relieving factors	3	13	8	0
	Dyspnea	3	4	17	0
	Cough	6	1	17	0
	Nausea	1	1	22	0
	Vomiting	5	1	18	0
	Appetite	0	3	21	0
	Bowels	0	1	23	0
	Previous similar pain	0	1	23	0
	Previous illness	9	10	5	0
	Previous surgery	4	3	17	0
Physical Exam Categories	Temperature	19	0	3	2
	Pulse	10	1	11	2
	Blood pressure	12	0	8	4
	Mood	0	6	12	6
	Color	0	6	12	6
	Sweating	0	2	16	6
	Shivering	0	1	17	6
	Jugular venous pulse	9	9	6	0
	Respiratory movement	19	3	1	1
	Heart sounds	2	12	10	0
	Percussion	3	13	7	1
	Chest sounds	2	18	4	0

0: The corpsman made no attempt to collect data.
1: The corpsman made an attempt to collect data, but his investigation was incorrect or incomplete.
2: The corpsman's investigation of the symptom category was correct and complete.
X: The observer was not able to judge the corpsman's performance.

collected data for these categories, they had done so before the beginning of the examination and before the arrival of the observer(s).

For Respiratory movement, the corpsmen were instructed to measure the difference between full chest inspiration and expiration by placing a tape measure at the level of the nipples. This was different from the procedure ordinarily used by the corpsmen to check Respiratory movement, a tape measure was not easily accessible, and, in general, the corpsmen appeared uncomfortable with performing the task in a new way.

Data Collection Incomplete or Incorrect

A rating of '1' was assigned if the corpsman made an attempt to collect data, but his investigation was incorrect or incomplete. A rating of '1' was assigned most often for the categories of Onset (number of 1's assigned was 12), Site (13), Severity of pain (15), Aggravating factors (13), Relieving factors (13), Previous illness (10), Jugular Venous Pulse (9), Heart sounds (12), Percussion (13), and Chest sounds (18).

In assigning a rating of '1', the observer recorded in what way the corpsman's data collection procedures differed from the suggested ones. Listed below are the suggested techniques and data collection procedures and a description of the ways in which the corpsmen's procedure deviated from the suggested ones for each of the categories that most frequently received a rating of '1'.

Onset of Pain: Onset of pain was defined as the length of time the pain took to develop fully. If the pain took less than 2 minutes, then onset is sudden. If the pain took more than 2 minutes to develop fully, then the onset is gradual. In each instance that a rating of '1' was assigned (n = 12), the corpsman did not define for the patient the difference between sudden and gradual onset.

Site of Pain: To determine the site of pain the corpsman should have the patient bare his chest and point with one finger to the area of greatest pain at the time of the examination. A rating of '1' was assigned on 13 cases. For 8 patients, the corpsman did not have the patient bare his chest, for 2 patients he did not direct the patient to point with one finger, and for 3 patients he did not have the patient bare his chest or point with one finger.

Severity of Pain: The severity of the patient's pain is based solely on the observations of the corpsman. The corpsman should not question the patient about the severity of his pain. In each instance that a rating of '1' was assigned (n = 15), the corpsman questioned the patient about his pain and appeared to base his assessment of the severity on the patient's responses. For each of these

cases, the observers were able to judge the corpsmen's performance without needing to base their ratings on the agreement between the findings of the corpsman and physician.

Aggravating Factors: Aggravating factors are any activities which make the patient's pain worse. The corpsman was instructed to ask specifically about each of 6 possible aggravating factors and to phrase the questioning in a neutral manner. Unless there is a suspicion of MI, the corpsman should have the patient perform each of these five named activities. A rating of '1' was assigned on 13 cases. The corpsman did not ask the patient about breathing in 8 cases, sitting in 7 cases, cough in 6 cases, other aggravating factors in 5 cases, and movement in 1 case.

Relieving Factors: Relieving factors are activities which ease the patient's pain. The corpsman was instructed to ask about each of 5 items specifically and in a neutral manner. There were 13 cases on which the corpsmen received a rating of '1'. The corpsman did not ask about walking in 11 cases, other relieving factors in 8 cases, rest in 7 cases, and nitroglycerin in 6 cases.

Previous Cardio-Respiratory Illness: Previous cardio-respiratory illness refers to significant illness in the past involving the cardiovascular or respiratory systems. The corpsman was asked to define for the patient what he meant by cardiovascular and respiratory, either by example or definition, cardiovascular involving the heart and respiratory involving the lungs. The corpsmen received a rating of '1' on 10 cases. For 3 cases, the corpsman inquired only about illnesses of the heart, and for another 3 cases only about illnesses of the lungs. For 4 cases, the corpsman did not define what he meant by cardiovascular for the patient.

Jugular Venous Pulse (JVP): The corpsman was instructed to stand on the patient's right side, have the patient recline at a 45 degree angle with his chin turned about 30 degrees to the left, and shine a light at an angle across the patient's neck so that the jugular vein cast a shadow. If the meniscus of the jugular vein is more than 1/2 the distance from the clavicle to the chin, then the JVP is abnormal. The corpsmen received a rating of '1' on 9 cases, and a rating of '0' on another 9 cases. For 4 patients, the corpsmen did not know how to perform the procedure and needed to ask for assistance; for 2 patients the corpsman stood to the left of the patient and turned the patient's head to the right; for 2 patients the corpsman did not have the patient reclined at a 45 degree angle; and for 1 patient the corpsman stood to the wrong side of the patient.

Heart Sounds: The corpsman was taught to have the patient bare

his chest and to listen to the first and second heart sounds by placing the diaphragm of the stethoscope at 3 or 4 locations around the nipple. The corpsmen received a rating of '1' on 12 cases. For 3 of these cases, the corpsman did not have the patient bare his chest; for 8 cases, he listened at only 1 or 2 locations; and for 1 case, the corpsman placed the stethoscope at the wrong location.

Percussion: The corpsman was taught to percuss 2 locations on the front and 8 locations on the patient's back, tapping the 3rd finger against the distal joint of the opposite 3rd finger. The corpsman was asked to compare sides, right and left, as he percussed. The corpsman received a rating of '1' on 13 cases. For 9 patients he did not compare one side to the other; for 2 patients he did not listen at all locations; for 1 patient he listened through the shirt; and for 1 patient the corpsman did not listen at all locations and he did not compare sounds.

Chest Sounds: The corpsman was asked to listen for chest sounds by placing the stethoscope at 8 locations on the patient's back and at 2 locations on the chest, having the patient breathe deeply and comparing sides. The corpsmen received a rating of '1' on 18 patients. For 6 patients, the corpsman did not listen to the patient's front; for 5 patients, the corpsman did not compare the chest sounds heard on one side to those heard on the other side; for 5 patients, the corpsman listened through the patient's shirt; for 3 patients, the corpsman did not listen to all locations; for 2 patients he did not listen to the patient's back; and for 1 patient he listened at the wrong locations.

Accurate Data Collection

A rating of '2' indicated that the corpsman's investigation was accurate and complete. A rating of '2' was assigned most often on the history categories of Duration (the corpsmen were given a rating of '2' on 19 patients), Time course (21), Progress (18), Dyspnea (17), Cough (17), Nausea (22), Vomiting (18), Appetite (21), Bowels (23), Previous similar pain (23), and Previous surgery (17). The rating of '2' was assigned most frequently on the physical exam categories of Mood (12), Color (12), Sweating (16), and Shivering (17). Each of these 4 physical exam categories were ones that were difficult to observe because the corpsman's findings were based on observation rather than a question or procedure done by the corpsman to the patient. The rating of '2' on Mood, Color, Sweating, and Shivering reflects, in all cases, the number of times the corpsmen's findings agreed with those of the physician.

Non-Observed Cases

Corpsmen conducted examinations and completed data sheets for 78

patients that were not observed. These cases were analyzed separately from the observed cases. Table 3 presents the symptom findings recorded by the corpsmen and physicians, and the percent agreement between their findings for the non-observed cases. The format used in Table 3 is the same as that used in Table 1.

Across all symptom categories the agreement between the findings of the corpsmen and physicians was 72%. The agreement between the findings of the corpsmen and physicians was 68% on the history and 78% on the physical exam items. The corpsmen were least accurate (accuracy < 60%) on the history categories of Duration, Radiates to, Aggravating factors, Relieving factors, and Dyspnea, and on the physical exam category of Examiner's opinion.

DISCUSSION

Most of the patients in this study presented with normal findings. Across 24 observed cases, the physicians recorded fewer than 5 abnormal findings for the history categories of Numbness, Dyspnea, Cough, Nausea, Vomiting, Appetite, and Bowels. The physicians did not report a single abnormal finding for the physical exam categories of Jugular Venous Pulse (JVP), Respiratory movement, and Percussion, and they recorded fewer than 5 abnormal findings for the categories of Heart and Chest sounds. The unequal distribution of symptom findings precludes conclusions based on the agreement between medical officers and corpsmen. Nothing can be said as to the corpsmen's accuracy for abnormal findings because of the low incidence of such findings. Statements about the corpsmen's accuracy for normal findings must be made cautiously. In the general population, most patients present with diseases and symptoms that are not significant, and so it is difficult to tell whether the corpsmen's accuracy for normal findings reflects high or low precision in discrimination. Similar results have been reported by Ryack, et al (1979), in an evaluation of the corpsmen's skill in diagnosing acute abdominal pain.

The purpose of the present investigation was to determine if corpsmen can collect chest pain data according to specific techniques and procedures. The findings suggest that corpsmen accurately collect data for some chest pain symptoms. The ratings assigned by the observers indicate that the corpsmen do well on history categories. For 13 of 20 history categories, the corpsmen's investigation was accurate and complete. The observer's ratings show that the corpsmen's performance was not as good on the remaining 7 history categories of Age, Onset, Site, Severity, Aggravating factors, Relieving factors, and Previous Illness. However, for each of these categories, the ways in which

Table 3: Symptom findings recorded by corpsmen and physicians, and the number and percent agreement between their findings on 78 non-observed cases of chest pain.

SYMPTOM CATEGORY	HN DATA	MO DATA	AGREEMENT #	AGREEMENT %	MISSING DATA
AGE	75	51	46	90	2
<30	22	15	14	93	
30-39	20	14	12	86	
40-49	12	8	7	88	
49+	21	14	13	93	
DURATION	75	50	22	44	3
<1 hr	15	9	3	33	
1-2 hr	5	8	2	25	
2-4 hr	11	6	3	50	
4-12 hr	21	9	6	67	
>12 hr	23	18	8	44	
ONSET	70	48	29	60	5
sudden	37	31	19	61	
gradual	33	17	10	59	
TIME COURSE	75	52	33	63	2
continuous	47	29	22	76	
intermittent	28	23	11	48	
RADIATION	61	46	33	72	7
present	26	20	12	60	
absent	35	26	21	81	
SITE	77	61	33	61	2
central	26	23	15	65	
across	2	3	1	33	
lt. side	28	23	14	61	
rt. side	11	4	2	50	
epigastric	4	6	1	17	
other	6	2	0	0	
RADIATES TO	45	24	8	33	4
left arm	16	8	6	75	
right arm	3	2	1	50	
both arms	0	2	0	0	
back	12	2	1	50	
shoulder	3	7	0	0	
neck	2	1	0	0	
jaw	0	0	0	-	
other	9	1	0	0	
NUMBNESS	76	51	44	86	2
present	15	11	7	64	
absent	61	40	37	93	
SEVERITY	77	52	38	73	1
moderate	49	44	32	73	
severe	28	8	6	75	
PROGRESS	73	46	30	65	4
better	46	21	17	81	
worse	27	25	13	52	
AGGRAVATING	98	77	31	42	0
movement	22	13	6	46	
cough	11	10	3	30	
breathing	14	24	8	33	
sitting	9	3	1	33	
other	11	2	0	0	
none	31	25	13	52	
RELIEVING	83	54	28	52	1
nitro	8	4	3	75	
rest	27	14	7	50	
walking	3	0	0	-	
other	13	10	2	20	
none	32	26	16	62	
DYSPNEA	78	52	28	54	0
no	50	37	23	62	
this illness	23	14	4	29	
habitual	5	1	1	100	
COUGH	78	52	39	75	0
no	57	41	35	85	
this illness	16	10	4	40	
habitual	5	1	0	0	
NAUSEA	76	52	41	79	2
present	25	19	12	63	
absent	51	33	29	88	
VOMITING	78	52	48	92	0
present	8	6	5	83	
absent	70	46	43	93	
APPETITE	76	52	40	77	1
normal	53	40	32	80	
decreased	23	12	8	67	
BOWELS	75	50	39	78	3
normal	69	48	39	81	
constipated	4	2	0	0	
diarrhea	2	0	0	-	

SYMPTOM CATEGORY	HN DATA	MO DATA	AGREEMENT #	AGREEMENT %	MISSING DATA
PREVIOUS PAIN	78	52	38	73	0
present	48	21	20	95	
absent	30	31	18	58	
PREVIOUS ILLNESS	78	52	44	85	0
present	19	15	10	67	
absent	59	37	34	92	
PREVIOUS SURGERY	78	51	35	69	0
present	39	15	11	73	
absent	39	36	24	67	
TEMPERATURE	62	44	28	64	6
<98.6	40	25	19	63	
98.6-100.2	19	16	7	44	
100.3-102	2	3	2	67	
>102	1	0	0	-	
PULSE	68	39	31	79	5
<60	0	0	0	-	
60-80	33	24	19	79	
81-100	26	11	8	73	
>100	9	4	4	100	
BP-SYSTOLIC	68	39	32	82	4
<100	3	1	1	100	
100-120	23	17	14	82	
121-140	24	8	7	88	
141-160	11	8	6	75	
>160	7	5	4	8	
BP-DIASTOLIC	65	39	30	77	5
<70	6	4	4	100	
71-80	31	19	15	79	
81-90	17	8	6	75	
91-100	9	5	4	80	
>100	2	3	1	33	
MOOD	77	51	35	69	1
normal	47	32	25	78	
anxious	23	18	9	50	
distressed	7	1	1	100	
COLOR	75	51	39	76	2
normal	62	42	36	86	
pale	9	9	3	33	
flushed	5	0	0	-	
cyanotic	0	0	0	-	
SWEATING	77	51	43	84	1
present	7	2	0	0	
absent	70	49	43	88	
SHIVERING	75	52	47	90	3
present	6	1	1	100	
absent	69	51	46	90	
JVP	70	52	42	81	6
normal	66	50	42	82	
raised	4	2	0	0	
RESP. MOVE.	76	52	42	81	1
normal	66	47	42	89	
abnormal	10	5	0	0	
HEART SOUNDS	74	50	45	90	1
normal	67	46	44	96	
abnormal	7	4	1	25	
PERCUSSION	66	44	38	86	2
normal	61	43	38	88	
dull	5	1	0	0	
hyper-resonant	0	0	0	-	
CHEST SOUNDS	71	48	38	79	3
normal	62	46	38	83	
rhonchi	4	1	0	0	
rales	1	0	0	-	
decreased	4	1	0	0	
BODY BUILD	74	49	41	84	1
normal	55	32	30	94	
obese	19	17	11	65	
EXAMINERS OPINION	71	48	25	52	4
good	35	41	20	49	
fair	34	6	5	83	
poor	2	1	0	0	

the corpsmen's procedure deviated from the suggested ones were such that additional training could easily improve their performance. For example, for both Aggravating and Relieving factors, the corpsmen need to ask specifically about each of certain activities; for Site of pain, they need to make sure that the patient's chest is bare and to have the patient identify the area of pain with one finger; and for Previous cardiovascular illness, the corpsmen need to define the term 'cardiovascular' for the patient and inquire about both problems of the heart and of the lungs.

The corpsmen's performance was not as good on physical exam categories. The observers found the corpsmen's investigation to be accurate and complete for only four physical exam categories: Mood, Color, Sweating, and Shivering. For the remaining eight categories (Temperature, Pulse, Blood pressure, Respiratory movement, JVP, Heart sounds, Percussion, Chest sounds), either the corpsmen did not attempt to collect data on the category or their investigation was incorrect or incomplete. For the categories of Temperature, Pulse, and Blood pressure, the corpsmen routinely collected data before the start of the examination and before the arrival of the observer(s). As a result, the observers' ratings were not a good measure of the corpsmen's performance. For the categories of Respiratory movement, JVP, Heart sounds, Percussion and Chest sounds, the procedures used by the corpsmen to elicit data were often different from the suggested procedures in ways that were marked enough to question whether additional training could ensure accurate data collection. For these categories, corpsmen first need to be taught procedures such as how to percuss, how to locate the jugular vein, and where to place the stethoscope. Second, corpsmen need to know how to interpret the data collected from the patient. For example, whether the sounds heard in the patient's lungs are normal or decreased, and, if added sounds are present, are they rales or rhonchi? These type of judgments are difficult for the corpsmen to make. Classroom training is probobly not sufficient; extensive 'hands-on' experience may be required to make sure that the data can be collected and interpreted accurately by the corpsmen.

SUMMARY

To summarize the results of this study, we found the overall agreement between the medical officers and the corpsmen to be 64% for 24 observed cases and 72% for 78 non-observed cases. For observed cases there was no difference between the corpsmen's accuracy on history and physical exam categories (64%). For non-observed cases, the corpsmen's accuracy on physical exam categories (78%) was slightly higher than it was on history categories (68%). The use of accuracy as a method of evaluating the corpsmen's ability to collect data from patients with

chest pain is not optimal since the corpsmen's accuracy is mostly a measure of their agreement with the physicians on normal findings. Observation worked well as a method of evaluating the corpsmen's performance on most categories. However, there were a number of categories (Severity, Mood, Color, Sweating, and Shivering) where the corpsmen's findings were not based on a particular question or procedure that could be observed and rated. For these categories, it was necessary to rely on the agreement between corpsman and medical officer as an assessment of the corpsman's abilities. On the remaining categories, the observers' ratings show that corpsmen do better on history than on physical exam items. Where errors are made in the collection of data on history categories, they are such that additional training could improve performance. Errors made in the collection of data on physical exam categories are more significant. In addition to training in the proper techniques to use in collecting data, the corpsmen need instruction in how to interpret the elicited data. Resolution of this problem may require more clinical, 'hands-on' training with on-site feedback from senior personnel.

The Navy corpsmen who participated in this study have less training than corpsmen assigned to independent duty aboard the submarine. In particular, all submarine corpsmen have at least 6 months of independent training, whereas none of those in this study had such training. While the conclusions of this study should be applied with caution to corpsmen formally qualified for submarine duty, they highlight the areas to be emphasized in corpsmen training to ensure proficiency in diagnosis of chest pain disease.

FOOTNOTE

[1]The number of cases evaluated by individual corpsmen ranged from none to four for observed cases and none to thirteen for non-observed cases. The distribution of cases was such that it was not possible to evaluate the performance of individual corpsmen or classes of corpsmen.

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Sixteen Navy Hospital Corpsmen received instruction in the definition of chest pain signs and symptoms, and in specific data collection procedures. The corpsmen conducted examinations of 102 patients presenting at an emergency room with chest pain. Their ability to collect history and physical exam data was evaluated by observation, and by the agreement between the findings of the corpsmen and those of the physician. The use of agreement with the physician as a method of evaluating the corpsmen's ability to collect data was found unsatisfactory. Agreement between physicians and corpsmen could have

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resulted from very accurate judgments by the latter or it could have been a by-product of reports by both groups that normal findings predominated. The observers' ratings showed the corpsmen's investigation of many history categories to be accurate and complete. The kind of errors made suggest that additional training could easily improve performance. The corpsmen's performance was not as good on physical exam categories. The kind of errors made suggest that the corpsmen need further instruction in procedures to collect data, and in interpretation of elicited data. Resolution of this problem may require more clinical, "hands-on" training with on-site feedback from senior personnel.

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